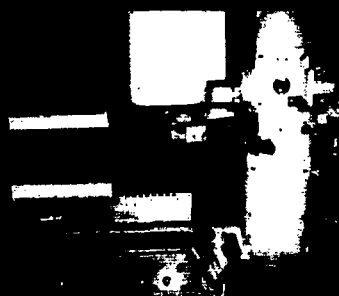
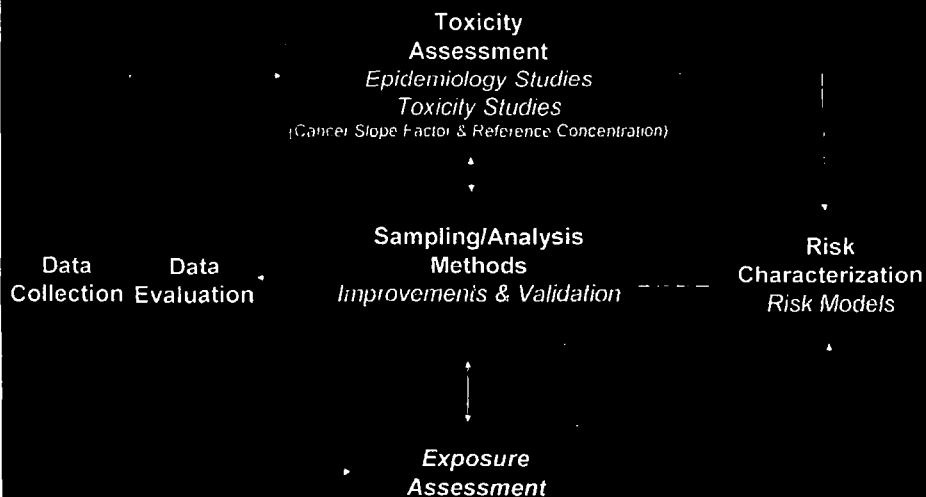


Sampling & Analysis Methods: *Data Gaps at the Libby Asbestos Site*



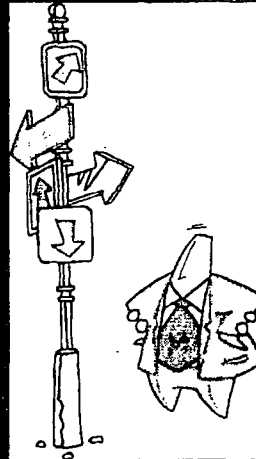
Mary Goldade
EPA Region 8
January 17, 2007

Data Gaps in Baseline Risk Assessment



Roadmap

- Sampling Overview
- Analysis Overview
- Method Improvements
& Verification Needed



Sampling Overview

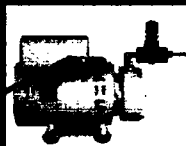
Sampling/Preparation

- Concentrate asbestos fibers while minimizing matrix effects

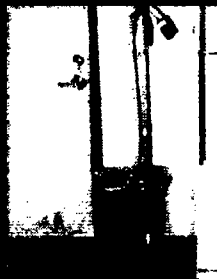
Sample Size

- Maximize sample size to maximize analytical sensitivity
- $\text{Volume (L)} = \text{Flow Rate (L/min)} \times \text{Time (min)}$

Stationary Air Sampling



High Volume Pump



Sample Cassette

$$\text{Volume} = \text{Flow Rate} \times \text{Time}$$

Validation Needed:



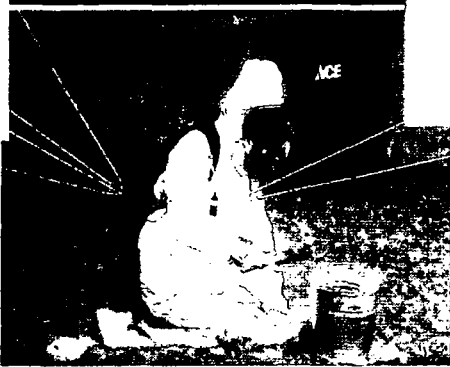
Outdoor ambient air sample collection techniques is critical

- Low flow rates paired with multi-day, continuous sampling

Activity Based Air Sampling



Personal Pump



Sample Cassette



Apply Worker/Personal Sampling concept to
Environmental Exposure Scenarios

Validation Needed:



Evaluation of sample filter efficiency for
collection of Libby Amphibole is critical to
ensure data accuracy

- ✧ Filter pore size ($0.8 \mu\text{m}$ and $0.45 \mu\text{m}$)
- ✧ Filter composition (mixed cellulose ester and polycarbonate)

Asbestos Fiber Identification

Morphology (physical)

- Length, width, aspect ratio (length : width)

Mineralogy (chemical & crystalline)

- Serpentine (chrysotile)
- Amphiboles (e.g., crocidolite, Libby Amphibole, plus many others)



Libby Asbestos

Morphology



Counting rules & procedures vary with the method of analysis.

Air Analytical Techniques (Briefly!)

Phase Contrast Microscopy (PCM)

- Not specific for mineral fibers
 - cat hair cellulose not discernible from asbestos fiber
- Can't observe fibers thinner than $0.25\ \mu\text{m}$
- PCM-Equivalent Fiber

Electron Microscopy (TEM/SEM)

- Mineralogy is estimated
- Transmission Electron Microscopy & Scanning Electron Microscopy reveal many thin/short fibers not observed by PCM.



2338 25KV X12 1mm WD37

**Optical Microscope
Resolution**



**Electron Microscope
Resolution**



2338 25KV X10,000 1µm WD37

Analytical Sensitivity - Balancing Act

Transmission Electron Microscope

Volume of Air (Liters)	#GO	Sensitivity (S/cc)	Approx. Cost
2,500	10	0.0012	~\$80
2,500	30	0.0004	~\$280
2,500	50	0.0002	~\$480

Analytical Sensitivity

- Must be low enough for risk assessment

Problem: Analytical counting rules rather than toxicological impacts generally drive what is identified/counted.

Improvement Needed:

Improved understanding of the relationship between morphology and toxicity will allow an appropriate strategy for analytical method development.

Analytical Tools for Soil

Improvement Needed:

Analytical tool(s) needed to measure the presence/absence of Libby Amphibole at levels less than ~0.05% (by weight)

- Validation of the glove box method for Libby Amphibole
SOP :: EPA Region 10-IEU-001 (Januch 2005)
- Development or refinement of other techniques that isolate/concentrate Libby Amphibole while minimizing matrix effects

